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Determining factors of the performance of inflation targeting in emerging markets: an empirical assessment

신흥시장의 인플레이션 목표의 실적에 결정적인 요소 : 실증적인 평가를 통하여

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Determining factors of the performance of inflation targeting in emerging markets: an empirical assessment

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Abstract

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Since 1990, 27 countries have adopted a monetary policy called inflation targeting. This policy is more and more being adopted as one of the principal methods of conducing monetary policy. This framework is particularly popular with emerging market economies as it successfully contributed to lower and maintain a steady rate of inflation. Recent studies show the positive impacts of inflation targeting on macro-economic variables. However, some countries are more successful in reaching their inflation target than others. This paper assesses empirical factors determining the ability of central banks to achieve their inflation target, measured by the gap between inflation target and actual inflation. What are the determining factors of the performance of such policy, in particular emerging market economies?

Previous literature has shown that institutional characteristics were the main determining factors of the performance of inflation targeting. I extend the search for the main determining factors of the success of inflation targeting. I find two additional layers of determining factors. Country-specific risk factors, such as country risk premium are a second layer of significant determinant of the success of inflation targeting. Then, factors

specific to emerging market economies are a third layer of determining factors. I extend the research for a new period of time 2011-2015, and broaden the perspectives by testing for new factors such as political risk factor, and by exploring specificities for emerging market economies. In this research, I examine various factors determining the inflation gap in three layers: institutional characteristics, country-specific risk factors, and factors specific to emerging markets. Empirical results from 2011 to 2015 suggest that factors related to institutional strength (fiscal discipline, central bank transparency, economic growth) and country-risk premium are most significant factors of the effectiveness of inflation targeting. Although this study does not reveal relevant additional factor specific to emerging markets, it shows that inflation gaps in emerging market economies are more sensitive to economic growth and country risk-premium than inflation gaps in developed economies.

Keywords: *Central bank, inflation targeting, monetary policy, emerging market economies, empirical analysis, performance*

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1. Introduction

1.1 Development of inflation targeting framework

Since 1990, inflation targeting has been adopted by a growing number of central banks as a pragmatic response to the failure of other monetary policy regimes. In particular for emerging economies that are progressively operating in a context of liberalized financial markets and free capital mobility, inflation have been rendered largely unstable in the last decade of the 20th Century. For example, Mexico adopted fixed exchange-rate targeting against the US dollar at the end of 1987, but was forced to move to a crawling peg in 1989, gradually rise the limit on the currency's allowable depreciation and then adopt a floating currency in 1994, as the foreign exchange reserves fell to very low levels. After this, Mexico has moved to inflation targeting. For Mexico and many other countries, the adoption of an inflation target was seen as a more appropriate way of conducting monetary policy.

1.2 Inflation targeting: definitions

What is inflation targeting? In this monetary framework, the Central Bank estimates and makes public a target inflation rate. It then attempts to steer actual inflation toward the target, with tools such as the interest rate. The Central Bank forecasts the future path of inflation and compares it with the target inflation rate. The gap between the forecast and the target arbitrates how much the monetary policy must be adjusted. Over

time, it became clear that inflation-targeting frameworks must include the following five main elements[1]:

- The public announcement of a medium-run numerical target for inflation;
- An institutional commitment to price stability as the primary goal of monetary policy, other goals being subordinated to it;
- An strategy that includes information from numerous sources and in which many variables, not just monetary aggregates or the exchange rate, are used for deciding the monetary policy;
- Increased transparency of the monetary policy strategy by communicating with the public and the markets about the plans, objectives, and decisions of the monetary authorities;
- Increased accountability of the central bank for attaining its inflation targets.

The role of the central bank is primarily to guarantee a steady rate of low inflation is maintained in order to provide a solid monetary background for the economy to develop. Inflation is the general change of prices of goods and services, usually measured by consumer price index CPI. Ideally, the target is a steady rate of inflation at a rate pre-determined by the Central Bank, for example between 2 and 4 percent, in a medium-run time period of 2-3 years.

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[1] Mishkin and Schmidt-Hebbel, 2001; Heenan, Peter, and Roger, 2006

1.3 Motivation of the research

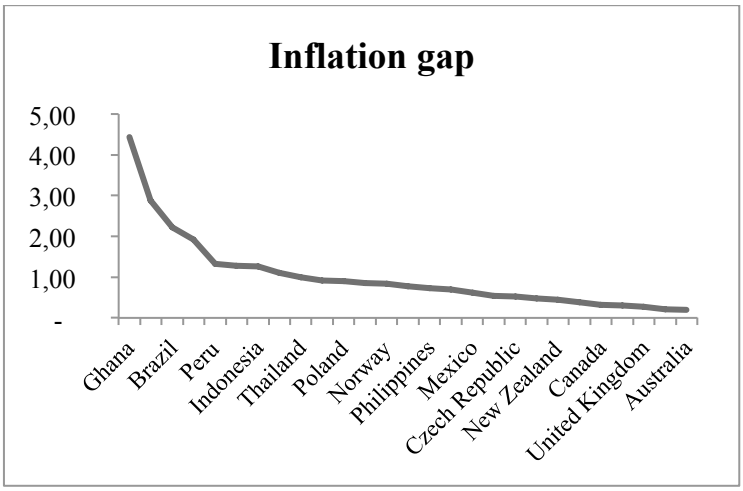
Central Banks and their monetary policies have a significant impact on the economic performance and stability of the domestic country. At the Graduate School of International Studies, I believe that it is particularly relevant to run an empirical cross-country analysis in order to compare the performance of each inflation-targeting country.

The literature on the benefits of inflation targeting framework is deep and well documented. Many researchers argue that countries that chose inflation targeting as their monetary policy framework faced a lower and stable inflation, as well as stabilized macroeconomic output, especially for emerging market economies. If central banks want to preserve their credibility, they have to succeed in achieving the publicly announced inflation target. However, some countries are more successful in achieving their inflation target than others. Surprisingly, there are not many studies that focus on the success of these inflation-targeting countries in achieving their target.

I measure the success of inflation-targeting country by the inflation gap, which is the difference between the actual inflation and the target inflation. Looking at the last five years (2011-2015), EMEs have much higher inflation gap, averaging 1,16% vs. 0,60% for developed countries. Australia (0,20%), Romania (0,22%), UK (0,27%), Colombia (0,30%) and Canada (0,32%) are the most successful countries. On the other hand, countries such as Ghana (4,43%), Turkey (2,88%), Brazil (2,22%), and Serbia (1,93%) have very high deviation from target. All four are emerging market economies. For this reason, I chose to focus the research on whether there are factors determining the

effectiveness of inflation targeting policy specific to emerging market economies.

<Graph 1: inflation gap per country>



Note: 2011-2015 average of inflation gap

The remainder of the paper is built as follows. Section 2 presents who are the inflation-targeting practitioners and what is inflation targeting. I review the literature on the effectiveness of IT compared to other monetary policy frameworks. I then show how some countries are more successful in achieving their inflation target. In section 3, I develop the research question. In section 4, I outline the methodology of the empirical analysis. I analyze the results in section 5. In section 6, I briefly summarize and bring limitations to the model.

2. Literature review

2.1 Inflation targeting practitioners

New Zealand, first adopted inflation targeting in 1990. Several other industrialized countries, such as Australia, Canada, Finland, Sweden and the United Kingdom followed afterwards. Many emerging market economies have also adopted inflation targeting, including Brazil, Chile, Israel, and Mexico. Inflation targeting became very popular in Latin America in the 90s because most of the countries in the region were affected by very high inflation. For example, Chile lowered inflation rates from 20% to 2% while experiencing very rapid economic growth, averaging 6% per year. The ERM crisis in 1992 served as the principal catalyst to the development of inflation targeting in Western countries[2]. Meanwhile, after the Asian crisis in 1997-98, an additional number of countries moved to IT (South Korea, Thailand, Philippines, Indonesia). Eventually, the policy framework has been adopted by many central banks both in industrialized and emerging market economies. Along with broader Bank Acts, inflation targeting has generally helped an environment of low and steady inflation rate, particularly given that most of these countries previously had a poor record for monetary stability. As of today,

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[2] Black Wednesday : « September 16, 1992. The day that investor George Soros short sold more than $10 billion worth of British pounds, which forced the Bank of England to withdraw from the European Exchange Rate Mechanism and to devalue the pound ».

there are 27 central banks that are considered full-fledged inflation-targeters, and some others such as the European Central Bank that conduct policies very similar to inflation targeting. As seen in the table below, 20 out of the 27 countries are emerging market economies. For the list of the countries practicing IT, I rely on Schmidt-Hebbel (2009), Sarwat Jahan (2012), Hammond G. (2012), Gonçalves and Salles (2008), Batini and Laxton (2006), and Ardakani and Kishor (2014).

<Table 1: Inflation targeting countries in the world, 2015>

Country	**Target (2015)**	**Adoption date**	**Group**
Armenia	4	2006	EME
Australia	2,5	1993	IND
Brazil	4,5	1999	EME
Canada	2	1991	IND
Chile	3	1999	EME
Colombia	3	1999	EME
Czech Republic	2	1997	EME
Ghana	8	2002	EME
Guatemala	4,5	2005	EME
Hungary	3	2001	EME
Iceland	2,5	2001	IND
Indonesia	4,5	2005	EME
Israel	2	1992	EME
Mexico	3	2001	EME
New Zealand	2	1989	IND
Norway	2,5	2001	IND
Peru	2	2002	EME
Philippines	4	2002	EME
Poland	2,5	1998	EME
Romania	2,5	2005	EME
Serbia	4	2006	EME
South Africa	4,5	2000	EME

South Korea	3	1998	EME
Sweden	2	1993	IND
Thailand	3	2000	EME
Turkey	5	2006	EME
United Kingdom	2	1992	IND

Note: EME and IND stand for Emerging Market Economies and Industrialized Economies. Source: Ardakani and Kishor (2014)

2.2 Effectiveness of inflation targeting

Is inflation targeting effective? Previous work on inflation targeting has focused on several benefits of inflation targeting. Numerous economists described inflation targeting as being successful in promoting macroeconomic stability. "It seems that countries that have adopted inflation targeting have experienced more focused and accountable monetary policy, strengthened policy credibility, reduced inflation levels and volatility, stabilized inflation expectations, and increased the tradeoff between inflation and output volatility" (Bernanke et al., 1999; Mishkin and Schmidt-Hebbel, 2002; Schmidt-Hebbel, 2004). In "*Inflation Targeting turns 20*", Scott Roger (2010) also argues that inflation targeting is associated with a higher reduction in the volatility of inflation. Gonçalves and Salles (2008) suggest that compared to non-IT countries, inflation-targeting countries "lowered their average inflation rates and output growth volatilities relatively more". Vega and Winkelried (2005), Mishkin and Schmidt-Hebbel (2007); Gonçalves and Salles (2008), and Lin and Ye (2009) also conclude that inflation targeting led to a better performance of the inflation, particularly for EMEs. Overall, although

empirical evidence on the performance of inflation targeting is not unanimous, it mainly supports the idea that the policy framework delivers low inflation and anchors inflation expectations in both industrialized and EMEs.

<Table 2: effectiveness of inflation targeting from previous literature>

Previous literature	Results
Bernanke et al., 1999; Mishkin and Schmidt-Hebbel, 2002; Schmidt-Hebbel, 2004	"More focused and accountable monetary policy, strengthened policy credibility, reduced inflation levels and volatility, stabilized inflation expectations, increased tradeoff between inflation and output volatility"
Scott Roger, 2010	Higher reduction in the variability of inflation
Gonçalves and Salles, 2008 ; Ball and Sheridan, 2005	Reduced average inflation rate and growth volatilities
Vega and Winkelried (2005), Mishkin and Schmidt-Hebbel (2007), Lin and Ye (2009)	Better performance of the inflation, especially for emerging countries

2.3 Comparing of the performance of inflation targeting countries

If inflation targeting is globally effective, some countries are more successful in achieving their inflation target than others. "Inflation Target Misses: a comparison of countries on inflation target", Monetary Bulletin 2005, from the Central Bank of Iceland,

make an empirical assessment of the average deviation from target for 21 selected inflation targeting countries from the beginning of inflation targeting to 2005. We observe that the average deviation from target in the sample is 0,2%. The inflation gap is lower for industrialized countries (0,0%) and higher for emerging markets (0,3%). The highest over shooters are Iceland (1,7%), Brazil (3,3%), Mexico (2,3%) and South Africa (1,6%). Interestingly, all four are emerging market economies. The deviations of actual inflation from target are considerably higher in emerging markets compared to those of developed countries. Thus, inflation target misses are an emerging market economy phenomenon. We will look at the potential determining factors of inflation gap, with a focus on emerging markets.

<Table 3: inflation target misses>

Country	Average deviation from target (%)	Standard deviation of target misses (%)	Frequency of target range misses (%)	Average value of target range misses (%)	Duration of target range misses (quarters)
Australia	0.2	1.1	51.0	0.8	4.2
Brazil	3.3	4.1	64.0	3.3	5.3
Canada	-0.4	1.0	37.0	0.6	2.0
Chile	0.0	1.5	43.0	1.2	4.3
Columbia	-0.3	1.9	40.0	1.0	4.0
Czech Republic	-1.9	2.0	81.0	1.8	5.5
Hungary	1.0	1.5	33.0	2.0	5.0
Iceland	1.7	2.3	33.0	1.7	3.0
Israel	0.0	2.8	82.0	1.8	6.4
Mexico	2.3	1.6	73.0	0.5	4.0
New Zealand	0.2	0.8	19.0	0.3	3.0
Norway	-1.1	1.2	61.0	1.0	11.0
Peru	-0.5	1.4	43.0	1.0	3.0
Philippines	-0.4	2.4	86.0	1.9	6.0
Poland	0.0	2.6	74.0	1.6	5.0
South Africa	1.6	2.3	50.0	2.1	7.0
South Korea	-0.6	1.7	46.0	1.3	3.3
Sweden	-0.9	1.1	48.0	0.8	6.7
Switzerland	-0.1	0.5	5.0	0.0	1.0
Thailand	-1.1	0.5	0.0	-	-
UK	0.0	0.4	0.0	-	-
Average of sample	0.2	1.6	46.0	1.3	4.7
Average of industrialised countries	0.0	1.1	32.0	0.7	3.9
Average of other countries	0.3	2.0	55.0	1.5	4.5

Source: "Inflation Target Misses: a comparison of countries on inflation target", Monetary Bulletin 2005, Central Bank of Iceland

2.4 Determining factors of inflation gap

First, previous literature have linked inflation gap with institutional factors. Calderón and Schmidt-Hebbel (2003) use factors such as "central bank independence" as determinants of policy credibility. They develop the idea that this measure significantly

decreases the level of inflation target misses. In “By How Much and Why do Inflation Targeters Miss Their Targets?”, Albagli and Schmidt-Hebbel (2004) argue that institutional strength is a major determinant of policy credibility and inflation gap. In “Examining the Success of Central Banks in Inflation Targeting Countries: the Dynamics of Inflation Gap and the Institutional Characteristics”, Ardakani and Kishor (2014) also find that “the relative success of these countries in achieving their targets depend on institutions and macroeconomic policy credibility.

Additionally, in “Inflation Targeting and Country Risk: an Empirical Investigation” 2013, IMF Working Paper, Armand Fouejieu A. and Scott Roger argue that *country risk premium* is lower for inflation targeting countries. Country risk premium can be defined as the additional risk associated with investing in a foreign country rather than domestic country. In parallel, Marshall and Cole, Global Report 2014, Conflict, Governance, and State Fragility Center for Systemic Peace (2014) propose an index, the state fragility index, which can be used to measure political fragility. I argue that factors related to the risks specific to the country are a second layer of determining factors.

A third layer of determining factors is factors specific to emerging market economies. Rahul Anand, Eswar Prasad, Boyang Zhang (2015) develop the idea that *share of food expenditures in total household consumption* is significantly higher in developing economies. The price of food being an essential component of the inflation in EMEs, I hypothesize that it may also be a determining factor of the performance of inflation targeting. Similarly, *access to financial services* is significantly lower in EMEs. I test this variable and hypothesize that this factor can affect actual inflation in inflation

targeting countries, especially in EMEs. Finally, we can distinguish two states of inflation targeting policy. A central bank using a convergence policy tries to lower the level of inflation target over time and usually has a higher inflation rate level. A central bank using a stabilization policy has already reached a low level of inflation and keeps it at this level. This distinction may also have a significant impact on the success of inflation targeting.

I summarize in the table below the hypotheses I make on the determinants of inflation targeting.

<Table 4: determining factors of the inflation gap>

Layer	Variable	Source
Institutional strength	Central Bank Independence (CBI)	Ardakani and Kishor (2014), Frederic S. Mishkin (2004)
	Central Bank Transparency (CBT)	Dincer and Eichengreen (2014), Frederic S. Mishkin (2004)
	Government debt	Frederic S. Mishkin (2004), Ardakani and Kishor (2014)
	Economic growth	Ardakani and Kishor (2014)
Country-specific risk factors	Country risk premium (CRP)	Albagli and Schmidt-Hebbel (2004), Fouejieu and Rogers (2013)
	Political Fragility	Marshall and Cole (2014)
Specific to emerging market economies	Share of food in total household consumption	Anand, Prasad, Zhang (2015)
	Financial development	Ardakani and Kishor (2014), Anand, Prasad, Zhang (2015), Dincer and Eichengreen (2014)
	Convergence / stationary	Ardakani and Kishor (2014)

3. Research question

3.1 Shortcomings of previous studies

Many researchers have shown that inflation targeting helped lower and stabilize the level of inflation, and improve macroeconomic output. However, some countries were more successful in achieving their inflation target than others. Albagli and Schmidt-Hebbel (2004), and Ardakani and Kishor (2014) identify institutional characteristics affecting the performance of inflation targeting. Fouejieu and Roger (2013) introduce country-specific risk factors. This research further develops the main determining factors of the success of central banks in achieving a low deviation from target inflation. I extend their research and broaden the perspectives for a new period of time, testing additional institutional characteristic factors, country-specific risk factors and by looking for factors specific to emerging market economies.

3.2 Research question

Based on the shortcomings identified above, this paper poses following research questions : what are the main determining factors of the performance of inflation targeting in 2011-2015? What are the specificities for EMEs?

3.3 Hypothesis

Based on previous literature, I hypothesize that there are three layers of

determining factors: institutional characteristics, country-specific risk factors, and factors specific to emerging markets.

4. Analytical framework

4.1. Data description

Inflation is measured by consumer price index (CPI), from *World Development Indicators*, World Bank. Inflation target is the explicit target fixed by respective Central Banks, collected from the respective Central Banks websites and previous literature. I measure inflation-targeting performance by the inflation gap, which is the absolute value of the difference between inflation target and inflation, and has been calculated with empirical data for this research.

In this research, I collect information for as recent as possible, by gathering yearly data for the last five years of available data (2011-2015). I was able to assemble the data for all the 27 inflation-targeting countries, including 7 developed countries and 20 emerging market economies. When needed, I have extrapolated values for missing countries for some variables by taking the average value in the region or by extending the trend in data from previous years. Average values of the explanatory variables vary significantly between EMEs and developed countries. Developed countries have more transparent central banks. The political fragility index scores on average 0.86 versus 5.70 out of 25. Developed countries have a financial development index of 99% while EMEs are at 55%. Developed countries tend to have a lower output growth, a higher debt to

GDP and a lower country risk premium.

<Table 5: descriptive statistics, EMEs and DCs>

	EMEs	DCs
Average CBI	0,53	0,43
Average CBT	8,86	11,86
Average debt to GDP	41,51	56,63
Average output growth	3,27	2,27
Average political fragility	5,70	0,86
Average country risk premium	3,20	0,51
Average share of total food in household consumption	27,76	10,41
Average financial development	55,09	99,04
Convergence	0,45	0

<Table 6: inflation target and misses>

Country	Inflation (%)	Inflation target (%)	Inflation gap (%)
Armenia	4,54	4	0,54
Australia	2,30	2,5	0,20
Brazil	6,72	4,5	2,22
Canada	1,68	2	0,32
Chile	3,38	3	0,38
Colombia	3,30	3	0,30
Czech Republic	1,47	2	0,53
Ghana	12,43	8	4,43
Guatemala	4,03	4,5	0,47
Hungary	2,22	3	0,78
Iceland	3,35	2,5	0,85
Indonesia	5,76	4,5	1,26
Israel	1,31	2	0,69
Mexico	3,61	3	0,61
New Zealand	1,55	2	0,45
Norway	1,67	2,5	0,83
Peru	3,32	2	1,32
Philippines	3,27	4	0,73
Poland	1,59	2,5	0,91
Romania	2,72	2,5	0,22
Serbia	5,93	4	1,93
South Africa	5,41	4,5	0,91
South Korea	1,90	3	1,10
Sweden	0,72	2	1,28
Thailand	2,00	3	1,00
Turkey	7,88	5	2,88
United Kingdom	2,27	2	0,27
Average of sample	3,57	3,24	1,02
Average of EMEs	4,14	3,60	1,16
Average of DCs	1,93	2,21	0,60

NB: time period 2011-2015, average of annual data

4.2. Methodology

I examine the determinants of inflation gap by running OLS regressions, with inflation gap as the dependent variable and hypothesized factors as independent variables. Inflation gap is regressed on their determinants as follows:

$$(1)\ Gap_{i,t} = \alpha_i + \beta X_{i,t} + \varepsilon_{i,t}$$

Where X is a vector of variables that affect the inflation gap and ε is a random error term. The indexes "I" and "t" indicate the individual country and time period, respectively.

I first run a regression with the base model containing institutional characteristics. Then I add country-specific risk factors. Finally, I test for factors specific to emerging market economies.

5. Results and findings

5.1 Base model: Institutional Characteristics of Inflation Gap

Several researchers demonstrated that the success of the monetary policy framework depends on the institutional strength of the inflation-targeting country. As a matter of fact, Mishkin and Schmidt-Hebbel (2001) argue that the success IT is based on five pillars, cited earlier. For this reason, I use a model utilizing institutional

characteristics. To do so, I examine the hypothesis that institutional strength determines the success of inflation targeting countries in achieving low inflation gap. I test for the role of central bank independence, central bank transparency, economic growth, and fiscal robustness. I measured the fiscal discipline by government debt-to-GDP, and macroeconomic output by GDP growth, that I collected from the WDI, World Bank. I interpreted central bank independence and transparency measures from previous literature by Dincer and Eichengreen (2014). Central bank Transparency is a 0 to 15 measure of political, economic, procedural, policy and operational transparency.

<Table 7: Institutional factors (OLS)>

	Dependent variable: inflation gap		
	(1)	(2)	(3)
DEBT	0,127	0,176*	0,006*
	(1,467)	(1,946)	(1,942)
GROWTH	-0,139	-0,16*	0,049*
	(-1,602)	(-1,815)	(-1,816)
CBI	0,211*		0,573**
	(2,539)		(2,489)
CBT		-0,182**	0,055*
		(-2,061)	(-2,004)
Constant	0,46	0,6***	0,664**
	(1,461)	(4,013)	(2,472)
Observations	135	135	135
R-squared	0,092	0,077	0,119
Number of country	27	27	27
F statistics	4,415	3,647	4,392

*T-statistics in parentheses, ***,**,* indicate the statistical significance at 1, 5 and 10% respectively*

To examine the impact of institutional characteristics on inflation gap, I run an

OLS regression as explained in the methodology section. I make a linear regression of the inflation gap with the variables : debt to GDP, economic growth, central bank independence and central bank transparency. Table 6 summarizes the estimation results of the analysis. The results are statistically relevant and signs on the coefficients are consistent previous literature.

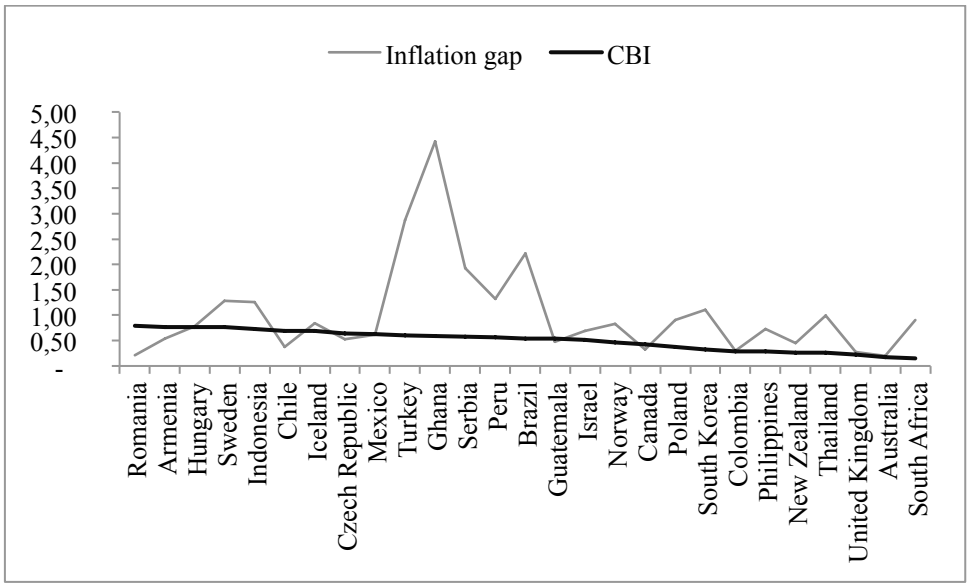
The results suggest that higher government debt is associated with higher inflation gap. This implies that fiscal discipline, as an indicator of institutional strenght, allows the central bank to act more prudently. High debt-to-GDP reduces the capacity of the CB to successfully achieve low inflation.

I observe that central bank transparency decreases inflation gap. I observe that in the second model, as the CBT index increases by 1 point, the inflation gap diminishes by 0,18%, meaning that the more a central bank's policy is transparent the lower its inflation gap. Going back to the 5 pillars of inflation targeting, one of the most important factors of success of inflation targeting is an increased transparency of the monetary policy strategy. High transparency of the Central Bank enhances the effectiveness of inflation targeting by "reducing the possibility of surprises in policy implementation and facilitate central bank independence". For this reason, inflation targeting central banks have "increased the transparency of policy making, through publication of inflation projections, publications of minutes of policy meetings, increased provision of information on websites, and so on"[3].

[3] Scott Roger, 2010

Surprisingly, the model shows that an increase in CBI increases inflation gap, which is an abnormal assumption. Looking at the graph below, we observe that this is due to two individual countries, Ghana and Mexico. Therefore we will use CBT as the best predictor, compared to CBI.

<Graph 2: CBI and inflation gap>



An increase in growth decreases inflation gap. Previous literature showed that inflation targeting contributes to reduce output and inflation volatility. This shows that a country with a more robust inflation targeting policy also has a higher GDP growth. Inflation targeting regimes have a positive long-run impact on growth. I choose model (2) as the base model. We get :

$$(1)\ INFG_{,t} = \alpha + \beta_1 * DEBT_{i,t} + \beta_2 * GROWTH_{i,t} + \beta_3 * CBT_{i,t}$$

Where $\alpha = 0,6$, $\beta_1 = -0,179$, $\beta_2 = -0,16$, and $\beta_3 = -0,182$.

5.2 Country-Specific Risk factors

We examine the relationship between inflation gap and country-specific risk factors. Previous literature states that the success of inflation targeting depends on country-specific risk factors, such as Country Risk Premium. The data for Country Risk Premium comes from Aswath Damodaran's measure of country risk premium (2016) based on Moody's Credit Risk rating and IMF International Financial Statistics. I add another index, Political fragility, from Marshall and Cole, Global Report 2014, Conflict, Governance, and State Fragility Center for Systemic Peace (2014) propose an index, the state fragility index. Political fragility increases the likelihood of central banks to miss their targets. Data on political fragility are from State Fragility Index and Matrix, Marshall and Cole (2014), Center for Systemic Peace.

I make a linear regression of the inflation gap with variables including the institutional factors (debt to GDP, economic growth and central bank transparency) and two country-specific risk factors, political fragility index and country risk premium. Table 7 summarizes the estimation results of the analysis. The results are economically meaningful.

<Table 8: Country-specific risk factors (OLS)>

	Dependent variable: inflation gap		
	(1)	(2)	(3)
DEBT	0,217**	-0,049	-0,056
	(-2,384)	(-0,598)	(-0,644)
GROWTH	-0,23**	-0,284***	-0,279***
	(-2,492)	(-3,762)	(-3,524)
CBT	-0,063	0,202**	0,195*
	(-0,617)	(-2,249)	(2,062)
POLF	0,249**		-0,026
	(2,219)		(-0,248)
CRP		0,667***	0,676***
		(7,529)	(7,041)
Constant	0,788	-0,039	0,693*
	(1,589)	(-0,065)	(0,068)
Observations	135	135	135
R-squared	0,111	0,357	0,358
Number of country	27	27	27
F statistics	4,048	18,071	14,365

*T-statistics in parentheses, ***,**,* indicate the statistical significance at 1, 5 and 10% respectively*

The first model shows a positive effect of political fragility. An increase in political fragility index increases inflation gap, which is consistent with previous literature. However, country risk premium is a much more robust indicator and is much more significant. An increase in CRP increases inflation gap. This is really in adequation with previous literature. Indeed, high CRP is associated with uncertainty in the country's economy and impacts economic agents' confidence in the ability of the Central Bank to achieve a desired level of inflation. This leads to inflation volatility.

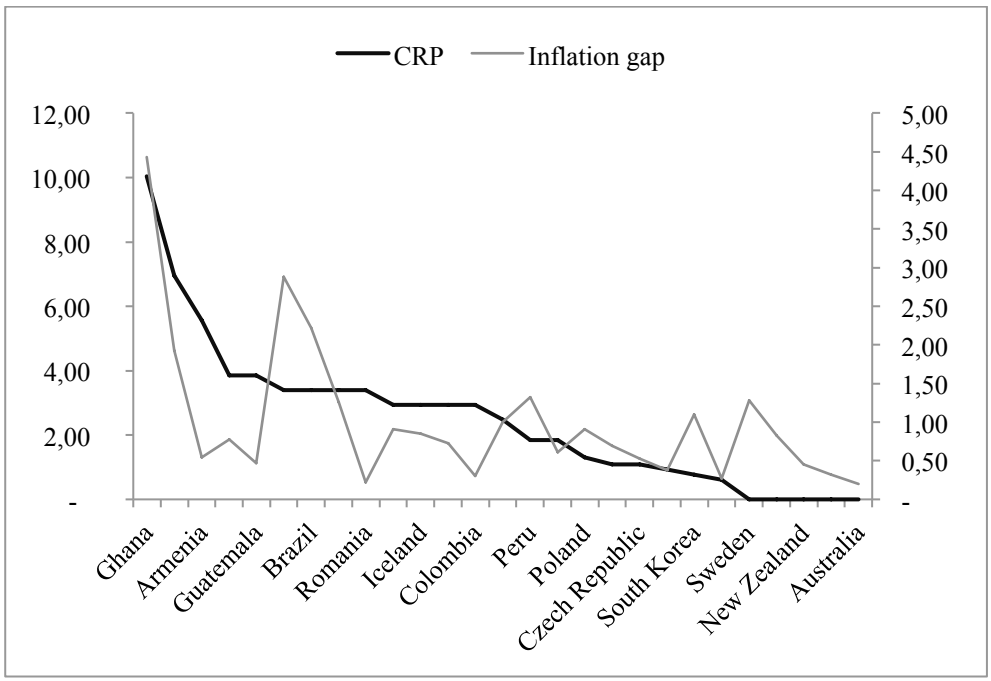
Because CRP and POLF are correlated, I must keep only one of the two

variables. I keep CRP, model (2) is the regression that most accurately predicts inflation gap, with an R-squared of 0,357 and F statistics of 18,071. The model includes the following specification:

$$(2)\ INFG_{i,t} = \alpha + \beta_1 * DEBT_{i,t} + \beta_2 * GROWTH_{i,t} + \beta_3 * CBT_{i,t} + \beta_4 * CRP_{i,t}$$

Where α = -0,039, β_1=-0,049, β_2=-0,284, β_3=0,202, and β_4=0,667. Graph 3 shows simultaneously average CRP and inflation gap for 2011-2015.

<Graph 3: CRP and inflation gap>



5.3 Factors specific to emerging market economies

Rahul Anand, Eswar Prasad, Boyang Zhang (2015) develop the idea that share of food expenditures in total household consumption is significantly higher in developing economies, the price of food being an essential component of the inflation in EMEs. Share of food in total household consumption is measured by the percentage of expenses in food compared to total household consumption. Data on share of food in total household consumption is gathered from USDA, Economic Research Service.

Financial development is measured by access to financial services. It is the percentage of individuals having access to financial services, as discussed in "What Measures of Inflation Should a Developing Central Bank Target?", by Rahul Anand, Eswar Prasad, Boyang Zhang, IMF Working Paper (2015). Data is collected from Global Findex database, World Bank, 2011. Financial development index is significantly lower in EMEs.

Finally, we can distinguish two states of inflation targeting policy. A central bank using a convergence policy tries to lower the level of inflation target over time and usually has a higher inflation rate level. A central bank using a stabilization policy has already reached a low level of inflation and keeps it at this level. This distinction may also be a significant factor for the success of inflation targeting.

I make a linear regression of the inflation gap with the selected institutional factors (debt to GDP, economic growth and central bank transparency), country risk premium, and factors specific to emerging market economies. Table 8 summarizes the

estimation results of the analysis.

<Table 9: Factors specific to emerging markets (OLS)>

	Dependent variable: inflation gap						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DEBT	-0,107	-0,110	-0,109	-0,106	-0,049	-0,107	-0,110
	(-1,086)	(-1,114)	-1,21	-1,172	(-0,584)	(-1,080)	(-1,108)
GROWTH	-0,272***	-0,241***	-0,24***	-0,237***	-0,284***	-0,269***	-0,238***
	(-3,55)	(-2,960)	(-2,989)	(-2,916)	(-3,737)	(-3,476)	(-2,901)
CBT	0,178*	0,145	0,145	0,141	0,202**	0,174	0,141
	(1,927)	(1,492)	(1,497)	(1,443)	(2,235)	(1,860)	(1,438)
CRP	0,764***	0,746***	0,744***	0,724***	0,666***	0,746***	0,729***
	(5,958)	(5,781)	(7,341)	(5,709)	(5,461)	(5,245)	(5,103)
FOOD	-0,148	-0,005				-0,16	-0,017
	(-1,051)	(-0,026)				(-1,089)	(-0,085)
FIN		0,186	0,189	0,195			0,185
		(1,126)	(1,547)	(1,565)			(1,118)
CONV				0,029	0,000	0,033	0,031
				(0,273)	(0,005)	(0,299)	(0,284)
Constant	0,539	-0,298	-0,322	-0,331	-0,039	0,584	-0,253
	(0,663)	(-0,271)	(-0,517)	(-0,529)	(-0,065)	(0,705)	(-0,226)
Observations	135	135	135	135	135	135	135
R-squared	0,363	0,369	0,369	0,369	0,357	0,357	0,369
Number of country	27	27	27	27	27	27	27
F statistics	14,689	12,478	15,09	12,497	14,345	12,169	10,63

*T-statistics in parentheses, ***,**,* indicate the statistical significance at 1, 5 and 10% respectively*

I find that none of the three factors are economically significant. The hypothesis that there are factors specific to emerging markets has not been validated. The best predicting model of the success of inflation targeting still remains (2) :

$$(2)\ INFG_{i,t} = \alpha + \beta_1 * DEBT_{i,t} + \beta_2 * GROWTH_{i,t} + \beta_3 * CBT_{i,t} + \beta_4 * CRP_{i,t}$$

Where α = -0,039, β_1=-0,049, β_2=-0,284, β_3=0,202, and β_4=0,667.

5.4 Determining factors for EMEs compared to DCs

<Table 10: EMEs and DCs>

	Dependent variable: inflation gap	
	(EME=1)	(EME=0)
DEBT	0,012	0,01
	(0,107)	(0,049)
GROWTH	-0,299***	0,063
	(-3,244)	(0,390)
CBT	0,093	0,514***
	(0,914)	(3,083)
CRP	0,568***	0,358*
	(5,535)	(1,735)
Constant	0,264	-1,829*
	(0,349)	(-1,839)
Observations	100	35
R-squared	0,356	0,266
Number of country	20	7
F statistics	13,148	2,72

*T-statistics in parentheses, ***,**,* indicate the statistical significance at 1, 5 and 10% respectively*

Although there is no factor specific to the success of inflation targeting in emerging markets, Table 9 distinguishes the coefficients of the dependent variables of model (2) for emerging market economies (EME=1) and for developed countries (EME=2). For emerging markets, the most important factors are output growth and CRP.

"For emerging market economies, that start at higher-than-stationary inflation levels and lack strong credibility at the start of IT, the boost in monetary policy strength and credibility brought by IT often implies larger benefits than those reaped in low-inflation inflation countries" (Corbo, Landerretche, Schmidt-Hebbel 2002). Over time,

inflation targeting brings down the level of inflation, reduces volatility in both inflation and output. The idea that an increased output growth increases inflation gap is consistent with previous literature. The size of the coefficients is considerable. For CRP, an increase of 1% would increase inflation gap by 0,568%.

6. Conclusion and limitations

6.1. Key learnings

This paper assesses the effectiveness of the 27 inflation-targeting countries in achieving their inflation targets. The descriptive statistics have quantified the level of inflation gap in the last five years and shown the heterogeneity in the success of inflation targeting for emerging market economies and developed countries. Considering several models, our data analysis suggests that the success of these countries in achieving their targets is first influenced by institutional factors (fiscal discipline, central bank transparency and economic growth), then country-specific risk factors (country risk premium), but not by factors specific to emerging markets. This finding for 2011-2015 is in line with assessments of previous theoretical literature. This research reveals that the inflation gap for inflation targeting emerging markets is more sensitive to variations in CRP and economic growth than developed countries.

6.2. Limitations related to the methodology

In this research, inflation targeting performance has been measured by the

inflation gap, which is the average yearly deviation from target. Some other researchers use alternative measures of inflation-target misses, such as average monthly deviations, standard deviations, frequency of target range misses, average value of target range misses and duration of target range misses are all relevant indicators of the success of inflation targeting regime. Additionally, wider volatility in inflation can be the consequence of a higher level of inflation. We may obtain different results by normalizing the values of inflation gap.

Time period can also be broadened to more than the last five years in order to obtain a more robust model. However I chose not to use data before 2011 in order to avoid high volatility values due to global financial crisis.

Many researchers also question the relevance of cross-country assessments, because countries are highly heterogeneous. Perhaps it can be more precise to study time series rather than cross-country analyses. However cross-country regression is widely accepted among economists.

To finish, IT regime contributes to gradually build-up the transparency and the credibility of central banks. Therefore, the adoption date of the IT regime and time passed since adoption of IT may have a high impact on the success of the policy.

6.3. Theoretical limitation of inflation targeting framework

It is arguable that deviations from inflation target are caused by the setting of the target, rather than by the result of the actual inflation level. The reason why inflation gap is wide is not necessarily due to the actual inflation but to an ambitiously low inflation

target.

In parallel, in "Think fast and slow", Daniel Kahneman describes the *anchoring effect*, which is the idea that the setting of a target highly influences the actual outcome. Inflation-targeting may be an effective policy not only because there are factors determining the effectiveness of such a policy but *per se*, because of the *anchoring effect*, signaling to the market that, given a certain credibility and, the Central Bank is likely to steer the actual inflation rate to its target level.

However, some critics of the inflation-targeting regimen like David Beckworth (2014) argue that the inflation is very difficult to control due to the lags under which the monetary policy operates. This problem is worse for emerging market countries, as Mishkin (2000) analyzed. These countries often face very high inflations that are meant to be brought down, but the monetary policy operates with very long lags and their forecast models often yield large errors. This combination of issues affects the central bank credibility of its ability of achieving the inflation target. Medium-term time lags make control of inflation very difficult.

On top, several researchers such as Brito and Bystedt (2008) argue that **"***there is no significant evidence to conclude that inflation targeting has met its goal to stabilize inflation in emerging economies*". They demonstrate that is a negative significant relation between inflation targeting and output growth.

In addition, we can question the appropriateness of the inflation-targeting framework. One major challenge for EMEs is to deal with both price stability challenges and concerns about exchange rate regime. Central Banks that have adopted IT face

conflict of objectives and have to decide between focusing on price stability or on financial stability. Especially after the global financial crisis, exchange rate volatility and financial stability are more and more key concerns for emerging market economies. The financial crisis of 2007 has shown that inflation-targeting emerging market economies were financially vulnerable and highly dollarized. How should Central Banks react in similar cases? Should monetary policy respond directly to potential risks to financial stability? Theoretically, the main goal of inflation targeting countries being price stability, they should exhibit flexible exchange rate. However, emerging markets still have a « fear of floating ». Inflation targeting central banks can be tempted to manage exchange rate more closely.

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8. Appendix : monetary policies

A monetary policy is a set of actions taken by the policy maker, often the Central Bank, which determine monetary variables such as inflation or monetary aggregates. Generally, it boils down to adjusting the supply of money in the economy to achieve some combination of inflation and output stabilization. Central Banks use tools such as interest rates, open-market operations, reserve requirements or money printing to adjust the money supply to keep stable price levels in the economy. There are several approaches to monetary policy.

Historically, developed countries generally used a monetary policy framework based on the size of *money supply*. In this framework, Central Banks use open-market operations to expand or reduce the money supply by monitoring monetary aggregates. The targeting of monetary aggregates has a number of benefits, but in practice, it is only advantageous when one can establish a high and predictable correlation between the monetary aggregate and the policy objective. To conduct a monetary policy based on monetary growth one must assume a close relationship between inflation and nominal monetary aggregates in the medium run; the problem is that this relationship is not so close in reality[4]. It eventually had limited success because the demand for money is highly unstable, and display strong fluctuations, especially during financial and economic crises. In most economies, the anchoring of monetary aggregates could not achieve interest rate, unemployment and inflation targets at the same time. For example, for

[4] Translated from French, citation of Olivier Blanchard and David Cohen

several decades, before using the inflation targeting policy, Korea had conducted its monetary policy under the targeting of monetary aggregates. The Bank of Korea set the M1 growth rate as the target in 1976 and changed the target to the M2 growth rate in 1979. M2 demand being stable, the bank was able to keep it close to the target value until the middle of the 1990s. However, with the diversification of financial products and the Asian financial crisis in 1997, monetary aggregates displayed too strong fluctuations. As a consequence, under the IMF program, the government amended the BOK act. This central bank act that came into effect in april 1998 set price stability as the primary objective of the BOK, shifting its policy framework to IT.

Another popular nominal anchor, particularly among emerging market economies, has been the *exchange rate targeting*. Such anchor may take the form of a *fixed exchange rate regime* or a *soft peg* and when it is adopted by small open economies, it is done in order to promote competitiveness, macroeconomic stability and growth. But this policy requires a great amount of foreign currency reserves to peg the exchange rate. If foreign reserves dry out due to the Central Bank's response to external shocks, then the policymaker can no longer maintain the fixed exchange rate and has to devaluate. When their exchange rates are not pegged outright, most emerging markets tend to manage their exchange rates more heavily than developed countries. Government measures to limit exchange rate flexibility reflect the desire to control inflation and to reduce the volatility in their markets. In the 1980s, Brazil suffered runaway inflation. After failing to stabilize their money, a new currency, the *real*, was introduced in 1994. The government allowed a crawling increase of the exchange rate of the *real*. However, because Brazilian inflation

was higher than foreign inflation, the currency experienced a net appreciation, making Brazilian economy become less competitive. Interest rates rose, banks failed, and unemployment increased. The market showed skepticism towards the ability of the government to maintain the controlled crawling of the real against the dollar, which led to a balance of payment crisis in 1998-1999. Brazilian foreign reserves dried out, and, even with the help of the IMF, Brazil had to devaluate its currency and then allow it to float freely, losing further value. Although the Brazilian economy recovered from such crisis, many emerging markets left the *exchange rate targeting* regime in favor of the *inflation targeting framework*.

9. Abstract : Korean (국문초록)

성명: 김중민

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1990년부터 27개의 국가들이 인플레이션목표제를 금융정책으로 도입했습니다. 이 정책은 낮고 꾸준한인플레이션률을 성공적으로 가져다줬으며 신흥 시장 경제에서 인기가 많은것으로 보입니다. 최근 연구에 의하면인플레이션 안정 목표제가 거시경제 변수에 긍정적인 영향을 끼친다느걸 알 수가 있습니다. 그러나 어떤 국가들은 다른 국가보다 인플레이션 목표에 도달하는데 더 많은 성공을 거두고 있습니다. 이 논문은 경험적 요소들로 중앙 은행들의인플레이션 목표 달성 능력을 평가하는 것이며, 이인플레이션 목표는 인플레이션 목표와 실제인플레이션의 차이를 측정한 결과입니다. 신흥 시장 경제에서 어떤 결정적인 요소들이 이 정책의 성공을 주는 것인가?

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핵심어: 중앙 은행, 인플레이션 목표, 통화의 정책, 신흥시장

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